

EXHIBIT “I”

(part 2)

- Q. Did you always leave there full?
A. Right. They had a meter on it per gallon.
Q. On how many occasions did you yourself go to Carpenter to pick up waste?
A. Thirty, 40.
Q. Over what period of time?
A. '73 to '75.
Q. The first time you went to Carpenter, had Ontario opened yet?
A. No.
Q. Did any of the Carpenter waste go back to disposal back to the Boarhead Farms site?
A. Yes, it did.

Additionally, a debit memorandum from Carpenter dated September of 1973 indicates that Carpenter employed DeRewal Chemical Company to unload and clean up leaking waste acid from a tank truck at the Carpenter waste treatment plant in July of 1973 (Carpenter Technology, 1973).

b. Merit Metals operated a non-ferrous metals fabrication facility in Warrington, Pennsylvania. On-site soil contamination at the Warrington facility included cis-1,2-dichloroethane, PCE and TCE along with lead, arsenic and zinc as contaminants of concern. TCE groundwater contamination was also discovered at the facility (RT Environmental Services, 2001a). According to the deposition testimony of Freddy DeRewal (DeRewal, F., 2003a, pg 93), Mr. DeRewal hauled waste from the Merit Metals site on three to four occasions.

- Q. How many times did you personally pick up waste at Merit Metals?
A. Me personally?
Q. You personally, yeah.
A. Three or four times.
Q. When was the first time you went there in timeframe wise?
A. '74, '75.

Further, in a letter dated January 26, 1972 from Manfred DeRewal, Sr., DeRewal Chemical Company submitted a proposal for the removal of "waste solution" by

supplying Merit Metals with a 4,000 gallon tanker to be filled with waste solution and removed by DeRewal Chemical Company. (Miller, 1995)

c. Flexible Circuits operated a manufacturing and assembly plant for the production of electronic circuits in Warrington, Pennsylvania during the relevant time frame (Flexible Circuits, 2003). Flexible Circuits is also the successor in interest to the Cherry Hill, New Jersey plant operated by Etched Circuits, which produced electronic circuitry (Flexible Circuits, 2003). Both plants produced numerous wastes including waste acids, spent etchant, and ammonia solutions containing copper, which were transported to the Site. In his deposition, Freddy DeRewal stated that he picked up drums from the Flexible Circuits facility in Warrington and transported the drums to the Site for disposal (DeRewal, F., 2003a, pg. 86-87).

Q. How many loads of drums did you pick up from Flexible and take for disposal at Boarhead?

A. I'd be guessing.

Q. I don't want you to guess. More than one?

A. More than one.

MS. FRIANT: Objection, move to strike.

He said he'd be guessing.

MR. HARRIS: Well, more than one's easy because he said he did it.

BY MR. HARRIS:

Q. How did that drum waste from Flexible get disposed of at Boarhead?

A. Well, a lot of times they were either loaded on the ground and whoever -- I don't know, they either emptied the drums or they apparently put the drums inside the holes. They didn't generate -- I don't know, maybe we went to Flexible maybe once every two months, once every month.

Additionally, invoices from DeRewal Chemical Company to Flexible Circuits document the transport of drummed wastes by DeRewal Chemical Company (BSAI051958; BSAI051960 - BSAI051961).

d. Southland Corporation, as the successor in interest to Ashland Chemical Company, operated a facility in Great Meadows, New Jersey (Southland Corp, 1988a) During the period from 1970 through 1977, the Great Meadows facility manufactured specialty chemicals and generated wastes including spent acids, spent solvents, and flammable liquids, among others, which were disposed of at the Site (Southland, 1988a). According to the testimony of Freddy DeRewal, Ashland wastes were hauled from the Great Meadows facility and disposed at the Site.

- Q. How many loads of Ashland waste did you take to Boarhead Farms for disposal, you personally?
- A. Eight to 15.
- Q. And of those loads that you personally took to Boarhead, where were they disposed of?
- A. They were disposed in front of the office at that time, right in front of the small pond.

Additional information such as Bills of Lading and purchase orders documenting the transport of wastes were provided in Southland Corporation's 104(E) Response Summaries (Southland, 1988a) (BSAI006473 - BSAI006796).

e. Thomas and Betts acquired the Ansley Electronics Corporation, a printed circuit board manufacturer, as a subsidiary in 1966 and collectively maintained operations in two facilities—one in Perkasio, Pennsylvania and another in New Hope, Pennsylvania through the late 1970s. In 1971, Thomas and Betts entered into an agreement with DeRewal Chemical Company to haul and dispose of waste from the Perkasio Facility (Thomas and Betts, 2003a). Wastes generated by the Perkasio facility and transported to the Site by DeRewal Chemical Company included waste etching solution and solvents in 55 gallon drums (Thomas and Betts, 2003a, THOM-0041). According to the testimony of John Bean (Bean,

2003, pg 52), Ansley Electronics had an established relationship with DeRewal Chemical Company through Revere Chemical Company and used the services of DeRewal Chemical Company for the hauling of drummed wastes.

- Q. Do you remember a company called Arthur Ansley?
- A. I remember the name, yes.
- Q. What do you remember about a company with that name?
- A. I think that was one of the outfits that we sold some chromic acid to, but that would have been at the Revere plant and also picked up some of the waste from Ansley, which would have been drum material, 55-gallon drums, I believe.
- Q. Did you personally ever pick up the 55-gallon drum material from an Ansley facility?
- A. I can't say that I did, but more than likely, I did, but that would have been at Revere.

f. Rahns Specialty Metals, Inc. acquired the former Techalloy Company, Inc., facility located in Rahns, Pennsylvania, in May of 1991. During the relevant period from 1969 through 1977, the Techalloy facility was operated as a manufacturing facility for specialty steel products, including wire rod and strip. According to the Rahn's 1992 response to the USEPA, industrial waste streams at the facility included spent pickle liquors, including potassium permanganate, sulfuric acid, nitric acid, nitric hydrofluoric acid, sodium hydroxide and muriatic acid. TCE was used in wire cleaning operations (Foster, 2003). In a letter to the Pennsylvania Department of Environmental Resources on October 12, 1972, Techalloy indicated that DeRewal Chemical Company will be used to haul away acids (Foster, 2003). As stated in his deposition, Freddy DeRewal personally hauled tanker truck loads of waste on three or four occasions from the Techalloy facility to the Site (DeRewal, F., 2003a, pg 131).

- Q. What was the size of the tanker that you took on that run?
- A. 4,000, 4,000 gallons.
- Q. How many times did you pick up waste from Techalloy, you personally?

- A. Three, four.
 Q. Where did you take the waste that you picked up from Techalloy?
 A. Boarhead.
 Q. All of it went there?
 A. Yes.

74. There is abundant documentary and testimonial evidence that wastes generated by Carpenter Technology Corporation, Merit Metals, Flexible Circuits, Southland Corporation, Thomas and Betts, and Rahns Specialty Metals contained hazardous substances and that each of these companies arranged for wastes to be transported to the Site. Based on the information and data that I reviewed, the wastes from one or more of these companies, if not all, would have contained the following hazardous substances:

- a. TCE and other chlorinated volatile organic compounds;
- b. Acetone;
- c. Methyl ethyl ketone;
- d. Nickel;
- e. Chromium; and
- f. Copper.

75. Under the Standard Industrial Classification ("SIC") system both Techalloy and Carpenter Technologies were classified as Primary Metal Industries under SIC Major Group 33 (as having manufactured specialty steel products). Merit Metals would have been classified as a non-ferrous metal fabrication industry (SIC Major Group 34), but would have had similar processes for operations such as cleaning, coating, forming and finishing of the metal products (USEPA, 1995a; USEPA, 1995b). Wastes generated from these generically similar operations would have been similar in type and composition with the exception of scale. Based on the information provided by USEPA through its Sector Notebook Project, the constituents of the waste streams from Merit Metals, Techalloy, and Carpenter Technologies would likely have

included heavy metals, spent pickle liquor, oil and grease, as well as degreasing and cleaning solvents, acids, and alkalis (USEPA, 1995a; USEPA, 1995b).

76. The manufacturing of the printed circuit boards and electronic circuits requires cleaning and coating processes that produce similar wastes to those in the steel and metal fabrication industry (USEPA, 1995c). Common chemicals used during the relevant time period for the cleaning of circuit boards and electronic circuits would have included acetone, TCE, sulfuric, and hydrochloric acid (USEPA, 1995c).

77. During the relevant time period, TCE was the solvent of choice and an industry standard (USEPA, 1995a; USEPA, 1995b; USEPA, 1995c; USEPA, 1982). TCE is an effective solvent that was readily available for a reasonable price. Additionally, TCE is denser than water, which allowed for easy separation when mixed with water, yet it is reasonably volatile to allow for rapid drying of cleaned or degreased parts and equipment without leaving residues. Because of its chemical and physical properties, TCE could be used interchangeably in the production processes of these facilities and as a result, was ubiquitous with industrial processes. Therefore TCE more likely than not, would have been common to each of these companies, Carpenter Technology Corporation, Merit Metals, Flexible Circuits, Southland Corporation, Thomas and Betts, and Rahns Specialty Metals and could not be identified as a fingerprint or marker compound for any particular waste stream.

vi. Allocation of Contributions

78. Evidence as to the amount of waste received at the Site is available from the deposition testimony of Freddy DeRewal, covering the bulk waste received, and the number of drums provided in the Federal On-Scene Coordinator's Report (USEPA, 1993) and the Remedial Construction Report OU-2 (Brown and Caldwell, 2004c).

79. Freddy DeRewal testified that for a period of 1-2 years (DeRewal, F., 2003a, pg. 34) approximately 5-10 tanker loads of bulk waste were received per week at the Site (DeRewal, F., 2003a, pg. 34). For the following two years (DeRewal, F., 2003a, pg. 31), receipts at the Site were 30 loads per week (DeRewal, F., 2003a, pg. 34). Tank sizes were given as 4,500 gallons (DeRewal, F., 2003a, pg. 34; pg. 91), 2,700 to 3,000 gallons (DeRewal, F., 2003a, pg. 95), 2,500 to 3,000 gallons (DeRewal, F., 2003a, pg. 107), and 4,000 gallons (DeRewal, F., 2003a, pg. 131).

80. Taking the initial time period as 1.5 years receiving 7.5 tanker loads of waste per week and the average of the tank sizes cited as 3,525 gallons³, the volume of bulk waste received in the initial period was calculated as

$$\frac{7.5 \text{ loads}}{\text{week}} \times \frac{52 \text{ weeks}}{\text{year}} \times 1.5 \text{ years} \times \frac{3,525 \text{ gal}}{\text{load}} = 2,062,125 \text{ gal}$$

plus an additional volume of waste received in the following two years

$$\frac{30 \text{ loads}}{\text{week}} \times \frac{52 \text{ weeks}}{\text{year}} \times 2 \text{ years} \times \frac{3,525 \text{ gal}}{\text{load}} = 10,990,000 \text{ gal}$$

for a total bulk waste received during these two periods of 13,060,125 gallons⁴.

81. If Freddy DeRewal hauled one tanker load of bulk waste from the Handy & Harman Facility to the Site for disposal, the representative volume of waste from the Handy & Harman Facility would have been 3,525 gallons. When compared with the total volume of bulk waste disposed at the Site, the total waste disposed of at the Site that could be attributed to

3. For this calculation, I used a conservative estimate of 3,525 gallons per tanker truck load to account for the differences in size between the different types of trucks used by DeRewal Chemical Company.

4. As a conservative measure, I only considered the 3.5 year time interval as described in the deposition testimony of Freddy DeRewal (DeRewal, F., 2003a, pg. 34) rather than extrapolating out to the full period of interest.

Handy & Harman would be

$$\frac{3,525 \text{ gal}}{13,060,125 \text{ gal}} = 0.00027 \text{ or } 0.027 \%,$$

a de minimis amount of waste, if any of the Handy and Harman Facility wastes ever reached the Site (USEPA, 1995d; USEPA, 1993b).

82. The amount of waste received in drums can be calculated from the number of drums recovered in the excavation activities reported in the Federal On-Scene Coordinator's Report (USEPA, 1993a) and the Remedial Construction Report OU-2 (Brown and Caldwell, 2004c). The total number of drums recovered by EPA was 2,500 (USEPA, 1993a) and the total number of drums removed with the remedial activities associated with OU-2 was 72 (Brown and Caldwell, 2004c).

83. Using a drum size of 55 gallons⁵, the total volume of drummed waste was

$$2,572 \text{ drums} \times 55 \text{ gallons} = 141,460 \text{ gallons.}$$

84. If, in the unlikely event that Bruce DeRewal's deposition testimony (B. DeRewal, 2003) is correct and 50 drums of waste from the Handy and Harman Facility reached the Site, this would have been equivalent to

$$50 \text{ drums} \times 55 \text{ gallons} = 2,750 \text{ gallons.}$$

The maximum allocation of drummed wastes attributable to the Handy & Harman Facility would have been

5. In order to be conservative, I used the value of 55 gallons for the volume of the individual drums removed from the Site. In some cases, this estimated volume exceeds the actual volume of waste disposed such as the case where the Handy & Harman Facility would have used some 30 gallon drums as well as 55 gallon drums. However, by using the value of 55 gallons per drum, the proportionate volume shares will remain the same and this calculation can account for at least a portion of the volume of wastes that was "emptied" and removed from drums at the time of disposal (See DeRewal, F., 2003a, pg. 86-87).

$$\frac{2,750gal}{141,160gal} = 0.019 \text{ or } 1.9 \%,$$

an insignificant quantity of wastes, if any of the Handy and Harman Facility wastes ever reached the Site.

85. Thus, the grand total volume of waste received as bulk plus the volume of the drummed wastes would be

$$13,060,125 \text{ gallons} + 141,460 \text{ gallons} = 13,201,585 \text{ gallons.}$$

Of this total,

$$\frac{141,460gal}{13,201,585gal} = 0.01072 \text{ or } 1.072\%$$

of the total waste disposed of at the Site, was received as drummed waste.

86. If the statements made in Bruce DeRewal's deposition (B. DeRewal, 2003) are taken at face value and 50 drums of waste from the Handy and Harman Facility reached the Site, the volume of drummed waste would be 2,750 gallons. Further, if Freddy DeRewal actually hauled one bulk load of spent acids to the Site from the Handy and Harman Facility (which is highly unlikely, see Paragraph 35 above), that would have added an additional 3,525 gallons of waste for a total of

$$2,750 \text{ gallons} + 3,525 \text{ gallons} = 6,275 \text{ gallons.}$$

Thus, based on the deposition testimony of Bruce and Freddy DeRewal, the fraction of the total waste disposed of at the Site that could be attributed to the Handy & Harman Facility would be

$$\frac{6,275gal}{13,201,585gal} = 0.00048 \text{ or } 0.048 \%,$$

a truly de minimis amount, if any of the wastes from the Handy and Harman Facility ever reached the Site (USEPA, 1995d; USEPA, 1993b).

X. Reservation of Right to Amend Report

87. I reserve the right to supplement or modify the opinions expressed herein upon which I expect to testify, to add to or modify the bases and reasons for my opinions and supplement the exhibits that I may use at trial for any of the following reasons: (1) to respond to expert reports, including but not limited to rebuttal reports, conducted for Plaintiffs or for any other party; (2) to respond to new information; (3) to respond to information obtained in discovery, including but not limited to depositions and interviews; and (4) as permitted by Rule 26 Fed. R. Civ. P. and the Scheduling Orders in this case.

Table 1: Contents of Drums Removed at the Boardhead Farms Superfund Site from the Federal On-Scene Coordinator's Report

Waste Group	# of Drums	Phase	Analysis	Arsenic	Copper	Oxydized	Cadmium	Chromium	Lead	Mercury	Selenium	Silver	Zinc	Benzene	CCl ₄	DCA	DNT	MEK	Nitrobenzene	PCE	TCE
1	25	liquid	en, od, ca, as																		
2	25	liquid	od, ca, hg																		
3	21	liquid	od, ca, pb, as																		
4	22	liquid	od, ca, pb																		
5	13	liquid	en, as, od, ca, as	X																	
6	20	liquid	en, as, od, ca, as																		
7	20	liquid	en, as, od, ca, as, hg																		
8	24	liquid	en, as, od, ca, as, TCE																		
9	15	liquid	od, ca, pb, as, MEK, TCE																		
10	19	liquid	od, ca, pb, as, MEK, TCE																		
11	21	liquid	MEK, TCE																		
12	22	liquid	MEK, TCE																		
13	21	liquid	od, ca, hg, MEK																		
14	21	liquid	od, ca, hg, TCE																		
15	17	liquid	od, ca, hg, Benzene																		
16	25	liquid	od, ca, hg																		
17	25	liquid	od, ca, hg																		
18	28	liquid	od, ca, hg																		
19	27	liquid	od, ca, hg, DCA, TCE																		
20	33	liquid	od, ca, hg																		
21	20	liquid	od, ca, hg, DCA																		
22	20	liquid	od, ca, hg, Benzene, DNT																		
23	20	liquid	od, ca, hg, Benzene																		
24	10	solid	od, TCE																		
25	6	liquid	od, ca, hg, Benzene, Nitrobenzene, TCE																		
26	18	liquid	od, ca, hg, Benzene, TCE																		
27	50	liquid	od, ca, hg, as, Benzene																		
28	48	liquid	od, ca, hg, Benzene, TCE																		
29	15	liquid	od, ca, hg																		
30	22	liquid	od, ca, hg, Benzene, TCE																		
31	101	liquid	od, ca, hg, Benzene, TCE																		
32	24	solid	od, ca, hg, TCE																		
33	10	liquid	Benzene, Nitrobenzene, PCE, TCE																		
34	17	liquid	od, ca, hg, Benzene, Nitrobenzene, TCE																		
35	26	liquid	Benzene, DCA, MEK, TCE																		
36	7	liquid	od, ca, hg, MEK, PCE, TCE																		
37	24	liquid	od, ca, hg, MEK, PCE, TCE																		
38	18	liquid	od, ca, hg, MEK, TCE																		
39	18	liquid	od, ca, hg, Benzene, MEK, TCE																		
40	12	liquid	od, ca, hg, Benzene, PCE, TCE																		
41	12	liquid	od, ca, hg, Benzene, PCE, TCE																		
42	19	liquid	od, ca, hg, Benzene, PCE, TCE																		
43	8	liquid	od, ca, hg, Benzene, PCE, TCE																		
44	13	solid	od, ca, hg, Benzene, TCE																		
45	61	liquid	od, ca, hg, TCE, cu																		
46	19	liquid	od, ca, hg																		
47	17	liquid	MEK																		
48	26	liquid	od, ca, hg, PCE, TCE, cu																		
49	25	liquid	od, ca, hg, PCE, TCE, cu																		
50	30	liquid	od, ca, hg, PCE, TCE, cu																		
51	46	liquid	od, ca, hg, PCE, TCE, cu																		
52	4	liquid	od, ca, hg, PCE, TCE, cu																		
53	8	liquid	od, ca, hg, PCE, TCE, cu																		
54	13	liquid	od, ca, hg, PCE, TCE, cu																		
55	4	liquid	od, ca, hg, PCE, TCE, cu																		
56	4	liquid	od, ca, hg, PCE, TCE, cu																		
57	8	liquid	od, ca, hg, PCE, TCE, cu																		
58	13	liquid	od, ca, hg, PCE, TCE, cu																		
59	4	liquid	od, ca, hg, PCE, TCE, cu																		
60	5	liquid	od, ca, hg, PCE, TCE, cu																		
61	0	liquid	od, ca, hg, PCE, TCE, cu																		
62	1	liquid	od, ca, hg, PCE, TCE, cu																		
Total	1248	liquid - 1188 solid - 47		34	127	79	1043	1048	427	80	188	44	1	213	83	20	20	21	33	110	636

Source: EPA, 1993. Federal On-Scene Coordinator's Report for Boardhead Farms NPL Site, June 19, 1992 to September 17, 1993.
 Acronyms Used: CCA = Carbon tetrachloride; DCA = 1,2-Dichloroethane; DNT = 2,4-Dinitrobenzene; MEK = Methyl Ethyl Ketone; PCE = tetrachloroethylene or Perchloroethylene;
 TCE = trichloroethylene; as = arsenic; ca = cadmium; cu = copper; hg = mercury; pb = lead; sa = selenium; sg = silver; zn = zinc

EXHIBIT A

Kirk W. Brown, Ph.D.

Biographical Data

Principal Consultant; SI Group, LP
Born: July 3, 1940; Bethlehem, PA
Citizenship: U.S.A.
Social Security Number: 171-32-2297
Marital Status: Married No. of Children: 3

Education

Ph.D., Agronomy, University of Nebraska, 1969
M.S., Agronomy/Plant Physiology, Cornell University, 1964
B.S., Agronomy, Delaware Valley College, 1962

Areas of Expertise

Fate and Movement of Salt, Oil, Metals, Organic Chemicals, Gases, Nutrients, Pesticides and Pathogens in Soil and Groundwater Environments; Remediation of Metal and Organic Chemical Contaminated Soils and Groundwater; Leachability and Translocation of Metals in the Soil Profile; Fixation and Stabilization of Metals in the Environment; Characteristics of Hazardous and Municipal Wastes; Industrial Waste Stream Identification; Classification and Fingerprinting of Waste Materials; Disposal of Municipal, Industrial, and Hazardous Waste by Land Treatment and Landfilling; Land Treatment of Sewage Sludge, Industrial Wastewater and Sludge; Bioremediation of Polluted Soils; Vapor Extraction of Soils; Toxicity and Risk-based Assessment of Soil Contaminants to Plants and Animals; Flux of Volatile Chemicals from the Soil Surface; Influence of Chemicals on the Permeability of Landfill Liners; Sources and Transport of Methane; Composting of Municipal and Hazardous Waste; Design and Operation of Septic Systems; Nonpoint Source Pollution; Expansive Properties of Clay Soils; Soil Solution Sampling; Fate of Mutagenic Compounds in Soil; Mold and Fungal Growth; Reclamation of Drastically Disturbed Lands; Aerial Photo Interpretation; Soil Use and Suitability Classification; Agricultural Water Use Efficiency; Crop Water Stress; Golf Green and Athletic Field Construction; Use of Windbreaks; Soil Crusting; Gas Movement in Soil.

Academic

Professor Emeritus, Soil and Crop Sciences, Texas A&M University, 2001-Present.
Professor, Soil and Crop Sciences, Texas A&M University, 1981-2001.
Associate Professor, Soil and Crop Sciences, Texas A&M University, 1973-1981.
Assistant Professor, Soil and Crop Sciences, Texas A&M University, 1970-1973.
Visiting Scientist, Center of Plant Physiological Research, Wageningen, Netherlands, August, 1969-July, 1970.
Research Assistant, University of Nebraska, June, 1965-December, 1969.
Teaching Assistant, Cornell University, September, 1964-June, 1965.

COURSES TAUGHT

Soil Physics (Undergraduate Course No. 445) 1970-2001.

The practical aspects of soil texture, structure, water management, as well as the theoretical aspects of soil water potentials, and the movement of water, ions, gas, and heat in the soil.

Advanced Soil Physics (Graduate Course No. 617) 1970-1988.

An in-depth study of the physical properties of soil including basic principles which regulate the dynamics of soil, water and ion movement, soil aeration, and soil thermal relationships. Equations describing these processes are presented and references to current literature are provided for outside reading.

Kirk W. Brown

Reclamation of Drastically Disturbed Lands (Graduate Course No. 615) 1979-1986.

Concepts influencing the reclamation, revegetation, and establishment of a stable ecological system on lands that have been drastically disturbed by strip mining, severe erosion, or toxic waste contamination.

Land Disposal of Wastes (Graduate Course No. 616) 1987-2001.

The theoretical and practical aspects of the land treatment and landfilling of a wide range of municipal, industrial, and hazardous wastes. Emphasis has been placed on the fate and mobility of various waste constituents in the soil and the influence of soil physical and chemical properties on constituent fate.

Short Courses Taught

Soil Science Institute (One month course) 1984, 1986, 1992, 1993

Land Treatment of Industrial Waste - Chemical Engineering Society, 1982, 1983.

Landfill Liner Design, University of Texas - 1986, 1987.

Society Memberships

American Society of Agronomy, 1970-2001

Soil Science Society of America, 1970-2001

American Chemical Society, 1970-2001

International Society of Soil Science, 1970-2001

Editorial Board

Environmental Engineering Science, formerly Hazardous Waste and Hazardous Materials. 1989-2001.

Reviewed Papers For

Soil Science Society of America Proceeding; Soil Science, Journal of Environmental Quality; Environmental Engineering Science, formerly Hazardous Waste and Hazardous Materials; ATSDR; American Petroleum Institute; Water, Air & Soil Pollution; Waste Management & Research, Water Pollution Control Federation; Water Research; Waste Management; Journal of Hazardous Materials; Archives of Environmental Contamination and Toxicology.

Elected Positions

Chairman, ASA Section A5, 1989-90

General program chairman for ASA meetings, 1973

Chairman, ASA Section A3, 1972

Committee Appointments

National Academy of Sciences, National Research Council Committee on Environmental Technologies Subcommittee on Landfills (1995-1998).

EPA Review for Risk Assessment for Petroleum Industry Hazardous Waste Listing Determination (Sept 1995).

Environmental Geosciences Advisory Committee of the American Geological Institute representing the Soil Science Society of America (1993-2000).

National Academy of Sciences (NRC) Committee on Remedial Action Priorities for Hazardous Waste Sites (1991-1994).

Texas Natural Resource Conservation Commission Committee on rules on Wastewater Treatment Plant Sludge, Water Treatment Plant Sludge and Septic Tank Sludge Disposal (1992-1993).

Texas Water Commission Committee to Develop Regulations on the Land Application of Sewage Sludge (1992-93).

Faculty of Toxicology Executive Committee, Texas A&M University (1990-93).

Texas Governor's Infrastructure Committee on Free Trade (1991).

Oklahoma Corporation Commission on Land Application of Oil Field Drilling Waste (1990-1991).

Texas Department of Health Ad Hoc Committee for Revising the Construction Standards for On-Site Sewage Facilities (1989-90).

EPA Hazardous Waste Center Review Panel (1988).

Kirk W. Brown

National Science Foundation, Environmental Engineering Div., Review Panel (1987-1995).
 Texas Dept. of Health Septic Disposal Regulations Revision Panel (1987).
 Advisory Panel to Chicot Aquifer Management Project (Louisiana). McNeese State University, LA (1987-1990).
 ASA Editorial Committee "Reaction and Movement of Organic Chemicals in Soils" 1987.
 Advisory Panel to U.S. Congressional Office of Technology Assessment (OTA) on An Assessment of the Effectiveness of the EPA in Identifying, Prioritizing and Cleaning Up Hazardous Waste Sites (1987-1995).
 Organizing Committee for SSSA Workshop on Utilization, Treatment and Disposal of Waste on Land (1985).
 Panel to Write Research Needs for Hazardous Wastes Treatment and Disposal for National Science Foundation. Drexel University, PA (1986).
 EPA Technical Advisory Panel on the Adequacy of Ground Water Monitoring at Hazardous Waste Landfills (1985).
 Panel to Write the Mutagenicity Sample Preparation Protocol for EPA (1984).
 EPA Panel to Review the Acceptability of Landfill Disposal of Sewage Sludge (1984).
 Office of Water Regulations and Standards Committee on Municipal Sludge Landfilling to Advise EPA on the Pollutants which should be Regulated for Various Disposal Options and the Methods or Procedures to be Used for Regulating such Pollutants (1984).
 Advisory Panel to U.S. Congressional Office of Technology Assessment (OTA) to Determine the Effectiveness of Current Programs to Clean Up Uncontrolled Hazardous Waste Sites (1983-84).
 EPA Science Review Panel for Environmental Engineering Research Grants (1982-1998).
 United States Environmental Protection Agency Land Treatment Task Force (1981-1985).

Significant Reports Resulting from Committee Assignments

National Research Council. 1999. "Groundwater & Soil Cleanup, Improving Management of Persistent Contaminants".
 National Research Council. 1994. "Ranking Hazardous Waste Sites".
 Office of Technology Assessment, Congress of the United States of America. 1989. "Coming Clean, Superfund Problems Can be Solved".
 Office of Technology Assessment, Congress of the United States of America. 1985. "Superfund Strategy".

University Committees

Texas A&M University Environmental Safety and Health Committee (1987-90).
 Council of Principal Investigators, Texas A&M University (1986-1990).
 Texas Agricultural Experiment Station 5-Year Planning Board.
 Texas A&M University Faculty Forum (1979-82).
 Texas Agricultural Experiment Station Grant Support Committee (1976-77).

Awards

Texas A&M University College of Agriculture Award for Excellence in Teaching (1995)
 Texas A&M University System Award for Excellence in Graduate Teaching (1988)
 ASA Environmental Quality Research Award (1988)
 Fellow - Soil Science Society of America (1987)
 Fellow - American Society of Agronomy (1986)
 Distinguished Alumni Award, Delaware Valley College (1986)
 Superior Achievement Award for Research, Soil and Crop Sciences Department, Texas A&M University (1986)
 Pollution Engineering Magazine Award of Merit for Outstanding Editorial Contribution "The Case for Aboveground Landfills" (1984)

Books Authored

Hazardous Waste Land Treatment. 1983. Butterworth Publishers, 10 Tower Office Park, Woburn, MA 01801.
Reactions and Movement of Organic Chemicals in Soils. 1989. Sawhney, B. L. and K. W. Brown. SSSA/ASA Publishers, SSSA Special Publication No. 22, 494 pgs.

Professional Experience Outside the United States

Visiting Scientist at Center of Plant Physiological Research, Wageningen (1969-70).

Kirk W. Brown

Testimony Before Legislative Bodies

Texas House of Representatives - Environmental Affairs Committee, April 1987. Testified on the need for legislation to set up a waste management plan for the state.

Texas Governor's Taskforce on Oil Spills, February 1985. Testified on the fate of oil spill debris and disposal technology options.

Texas Governor's Taskforce on Hazardous Waste, November 1984. Testified on the effectiveness of landfills for disposal technology.

Texas Governor's Taskforce on Hazardous Waste, June 1984. Testified on the impact of organic chemicals on the permeability of soils.

U.S. House of Representatives - Science and Technology Committee, November 1982. Testified on the adequacy of EPA's liquid management system to protect groundwater at hazardous waste landfills.

Texas House of Representatives - Environmental Affairs Committee, April, 1982. Testified on the impact of organic chemicals on the permeability of clay liners.

Consulting

Founder and President of K. W. Brown and Assoc., Inc., (1980- 1991). Chief technical consultant to K. W. Brown Environmental Services (1991-1999) and SI Group, LP (2000-Present). Past consulting activities have included assignments with a variety of industries, state, and federal government agencies, including General Motors Corporation, Minnesota Mining & Manufacturing, WR Grace, Union Pacific Railroad, Chevron, Shell, Exxon, Texaco, Arco, Sunoco, El Paso Products, New York Attorney General's Office, Illinois Attorney General's Office, Minnesota Attorney General's Office, Michigan Pollution Control Administration, U.S. EPA, U.S. Army Corps of Engineers, and U.S. Dept. of Justice.

Consulting activities have included consultations on the cleanup and disposal of wastes, the impacts of hazardous waste on the environment, the design of hazardous waste landfills and solid waste management units, and the fate and mobility of chemicals in the soil, groundwater, and air, as well as, providing expert testimony at permit hearings, mediation hearings, civil suits, and before legislative bodies on these topics. My expertise has been utilized for site assessments, data review and interpretation, the study of fate and transport of contaminants in the environment, waste management activities, historical landfill operations, and other related environmental matters. I have reviewed and interpreted a large quantity of analytical data for air, soils and groundwater, as well as borings logs, field logs, technical reports, and other information related to the environmental conditions of a site. I have prepared and reviewed remedial action plans for hundreds of sites including sites contaminated with metals, organic chemicals, pesticides, biological pathogens and petroleum production wastes. I have designed and implemented remedial actions at numerous hazardous waste sites under the auspices of both state and federal regulatory authorities.

As a consultant, I have evaluated or analyzed hazardous substances in industrial waste streams from numerous industries including the lumber and paper industries, the printing industry, chemical manufacturing, petroleum processing and refining, plastics and rubber products industry, leather tanning and finishing, metal smelting and finishing, electric utilities, and the electronic components manufacturing industry, among others. I have conducted extensive research on the hazardous substances contained in municipal and household waste with a special emphasis on the fate and mobility of these constituents in the environment after disposal in municipal solid waste landfills. I have provided evaluations and assessments for numerous waste disposal and landfill sites including the following: Love Canal Landfill, Lowrey Landfill, Helen Kramer Landfill, Junker Landfill, Lemberger Landfill, Laurel Park Landfill, Beacon Heights Landfill, RCA-Buzby Landfill, Valleycrest Landfill, Lone Pine Landfill, Ft. Bend County Landfill, and Sinton Landfill, among others. In addition, I have also provided expert testimony for civil actions involving the following Superfund sites: Hardage Criner, Montana Pole, National Gypsum, Brio/Dixie Oil Processors, Sikes' Pits, Turtle Bayou, Metal Bank of America, Tar Creek, and the West Dallas Lead Site.

Guest Lectures

Dewatering of confined dredge spoil areas. In: *Second International Symposium on Dredging Technology*. BHRA Fluid Engineering, Cranfield, Bedford, England. Paper G1:1-24. (1977).

Revegetation of drastically disturbed lands. Texas A&M Lignite Symposium. April 17-18. (1980).

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- Impact of surface mining on water quality. Texas A&M Lignite Symposium, April 17-18, 1980.
- Factors influencing the biodegradation of API separator sludges applied to soils. Presented at the Seventh Annual Research Symposium at Philadelphia, PA. March 16-18, 1981.
- Land treatment of industrial hazardous wastes. Presented at a Symposium and Workshop on Hazardous Waste Management. Louisiana State University, November 16-20, 1981.
- Effect of organic chemicals on clay liner permeability. A review of the literature. Presented at the Sixth Annual Research Symposium at Philadelphia, PA. 1981.
- Land disposal of oily wastes. Brest, France. August, 1982.
- Influence of organic liquids on the permeability of clay soils. Harwell, Great Britain. July, 1982.
- Use of sewage effluent for irrigation. Adelaide, Australia. June, 1982.
- Influence of organic liquids on the integrity of liners to pits, ponds, lagoons and landfills. Waste Water Analysts Assoc., Houston, TX. November, 1982.
- Reclamation of strip mined lands. Sierra Club, Austin, TX. November, 1982.
- Waste disposal on range land. Range Science Department, Texas A&M University. College Station, TX. November, 1982.
- The politics of hazardous waste disposal. Political Science Department, Texas A&M University. College Station, TX. October, 1982.
- The treatment and disposal of hazardous, industrial and toxic waste. American Society of Civil Engineers, Austin, TX. September, 1982.
- Effect of organic fluids on the permeability of clay soil liners. Presented at the Eighth Annual Research Symposium at Ft. Mitchell, Ky. March 8-10, 1982.
- The fate of mutagenic compounds when hazardous wastes are land treated. Presented at the Eighth Annual Research Symposium at Ft. Mitchell, Ky. March 8-10, 1982.
- The influence of chemicals on the permeability of clay liners. Presented at Hazardous Waste Conference, Chicago, Ill. June 28-29, 1983.
- Cleanup of chemicals spilled on soils. Presented at the Texas Agricultural Extension Service Conference, Houston, Texas. June 23, 1983.
- The reclamation of strip mined land. Presented at Texas Environmental Coalition in Austin, Texas Jan. 22, 1983.
- The influence of selected organic liquids on the permeability of clay liners. In: D. W. Shultz (ed). Land Disposal, Incineration, and Treatment of Hazardous Waste. Proceedings of the 9th Annual Research Symposium at Ft. Mitchell, Ky. May 2-4, 1983.
- Panel on land treatment of sewage sludge. EPA Workshop on Sewage Disposal, Denver, CO. March 1983.
- Land disposal of hazardous liquids. Waste Management Conference, Houston, TX. February 1983.
- Alternatives to land disposal of waste. Dept. of Agriculture Seminar, University of Houston. Sept. 10, 1984.
- How to write a successful research proposal. Soil Science Graduate Seminar, Soil & Crop Sciences Dept, Texas A&M University, Sept. 19, 1984.
- The advantages of above ground disposal. Waste Tech Conference, Houston, October 30, 1984.
- Potential groundwater implications of surface storage of toxic substances. Groundwater Symposium, Gunter Hotel, San Antonio, Texas. October 30, 1984.
- Clean up of spills; Alternative disposal methods. Geotechnical Engineering for Waste Disposal Symposium, University of Texas, Austin. November 2, 1984.
- The properties of soils and containment of waste. Environmental Engineering Seminar, Civil Engineering Dept., Texas A&M University, College Station, 1984.
- Carbon dioxide flux at the earth's surface. Texas A&M University, College Station, February 1984.
- Above ground landfills in hazardous waste management schemes. National Conference and Exhibition on Hazardous Waste and Environmental Emergencies. Houston, Texas, March 1984.
- Fate of mutagens applied to soil. Environmental Toxicology and Pharmacology Seminar. Texas A&M University, College Station, March, 1984.
- Permeability of compacted soils to solvents mixtures and petroleum products. Presented at the Tenth Annual Research Symposium at Cincinnati, Ohio, April 1984.
- Simulation of Potential Rainfall Conservation from Two Cross-Diked Furrow Bed Designs. Texas A&M University, College Station. February 1984.
- The soil scientist as a consultant. Soil Science Graduate Seminar, Panel Discussion. Soil & Crop Sciences Dept, Texas A&M University, Sept. 12, 1984.

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Land disposal of hazardous waste. Agricultural Engineering Dept. Graduate Seminar, Agricultural Engineering Dept., Texas A&M University. Sept. 13, 1984.

Geotechnical engineering for waste disposal projects. University of Austin, Texas, October 1985.

Monitoring the unsaturated zone. Presented at the National Specialty Conference. Land Treatment: A Hazardous Waste Management Alternative, April 16-18, 1985, Austin, Texas.

Ability of sorbents to retain liquids in landfills, 10th Annual American Organization of Analytical Chemists' Spring Workshop, Dallas, Texas April, 9-11, 1985.

Geotechnical engineering for waste disposal projects. University of Austin, Texas, October 1986.

Potential health effects of hazardous waste contaminants in groundwater. Public Health Grand Rounds, University of Pittsburgh Graduate School of Public Health. January 23, 1986.

Geotechnical engineering for waste disposal projects. University of Texas, Austin, October 1986.

Influence of organic liquids on the hydraulic conductivity of soils. University of Cambridge, United Kingdom. September 9-11, 1987.

Design and construction of the growth media in golf greens, Montreal, Canada, 1987.

Groundwater pollution problems associated with fertilizers, pesticides, and leaking storage tanks. Pro Show, Dallas, November 1987.

Mutagenic testing of hazardous waste sites. Southwest Environmental Mutagenic Society, Houston, November 1987.

The use of lime for waste disposal and treatment of hazardous waste contaminated sites. National Lime Association, Phoenix, AZ, April 1987.

A soil scientist as an expert witness - Presented to the Soil Survey and Land Resource Workshop. February 19, 1988.

Guest lecture to Rio Brazos Audubon Society - May 2, 1988.

Presentation to the Texas Association of Milk, Food and Environmental Sanitarians, June, 1988.

Guest lecture to Range Science Ecology and Land Use class. Dept. of Range Science, Texas A&M University, Nov. 18, 1988.

Hazardous Waste: A general overview. Agricultural Engineering, Environmental and Water Resources Engineering and Texas Water Resources Institute Seminar, Texas A&M University, College Station, TX. January 1989.

The need for community recycling. Environmental Organization, Civil Engineering Dept., Texas A&M University, College Station, TX. February 1989.

Superfund sites: The problems and the solutions. Industrial Hygiene Seminar, Texas A&M University, College Station, TX. February 1989.

Hazardous waste disposal on the Gulf Coast Texas. Texas ASA Annual Meeting. Galveston, Galveston County, Texas, February 1989.

New technologies for liners - Presented at the Conference on Prevention and Treatment of Groundwater and Soil Contamination in Petroleum Exploration and Production. Calgary, Alberta, Canada, May 9-12, 1989.

Guest Lecture to Range Science Ecology and Land Use Class: Dept. of Range Science, Texas A&M University, College Station, TX. Oct. 4, 1989.

Ongoing and future research in the geowaste area. Presented to the Geo Waste Group Meeting, Civil Engineering Dept. Texas A&M University, Nov. 1, 1989.

Waste disposal: where do we go from here? Presented to the MSC Great Issues: Environmental Symposia. Texas A&M University, College Station. Nov. 7, 1989.

Innovative technologies from the 1990s in environmental matters. Presentation to South Texas College of Law Environmental Law Symposium, January 17, 1990.

Waste disposal, past, present, and future. Presented at the seminar entitled "Disposing of Hazardous Materials". MSC, Texas A&M University, College Station, TX January 1990.

Panel discussion session at Vertisol Management Workshop: International Collaboration in Research, Training and Extension. Texas A&M University, College Station, June 25-29, 1990.

Municipal waste disposal - where do we go from here. Presentation to Texas Environmental Action Coalition, Texas A&M University, College Station, TX. Sept. 5, 1990.

Presentation to the Texas Section of American Society of Agricultural Engineers, College Station, TX. October 11, 1990.

Presentation on golf green construction at Canadian Golf Superintendents Association Conference, Montreal, Canada. Dec. 11, 1990.

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- Environmental Soil Science and Technology. Presentation to the 1991 Texas Agric. Experiment Station Conference - Environmental Soil Science Session, College Station, TX. January 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Association of Agricultural Consultants. Austin, Texas, January 21, 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Agricultural Extension Service Conference for Producers, Austin, TX, January 25, 1991.
- Pesticide rinsate disposal options. Presentation to the Research Center Administrators Society meeting, Dallas, Texas February 3-5, 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Agricultural Extension Service Conference for Grounds Keepers. Round Rock, Texas, February 21, 1991.
- Liners for Hazardous Waste Sites. Presented at the Hazardous Waste Management Division's Lecture Series. U.S. Environmental Protection Agency, Region 6, 1445 Ross Ave., Suite 1200, Dallas, TX. 1991.
- Decontamination of polluted soils. Presented at the Second International Conference on the Biogeochemistry of Trace Elements, Taipei, Taiwan, Republic of China. Sept. 5-10, 1993.
- Using plants to reclaim contaminated sites. Crop Science Seminar. Soil & Crop Sciences Dept., Texas A&M University, College Station, TX, October 24, 1994.
- Vadose zone modeling of the fate and movement of volatile contaminants, Geological Society of America, South-central Section Conference, Austin, TX, March 12, 1996.
- Banning of liquid wastes from landfills - development of the technical data and the regulations, South Texas Environmental Conference, Corpus Christi, TX, March 29, 1996.
- The science behind RCRA/CERCLA enforcement (Part II), Science For Environmental Attorneys, Denver CO, November 6, 1997.

Scientific Publications

1. Allen, L. H. and K. W. Brown. 1965. Shortwave radiation in a corn crop. *Agron. J.* 57:575-580.
2. Brown, K. W. and W. Covey. 1966. The energy budget evaluation of the micrometeorological transfer processes within a corn field. *Agri. Meteor.* 3:73-96.
3. Brown, K. W. and L. J. Wright. 1967. Comparison of momentum and energy balance method of computing vertical transfer within a crop. *Agron. J.* 59:427-432. C701.
4. Brown, K. W. and N. J. Rosenberg. 1968. Errors in sampling and infrared analysis of CO₂ in air and their influence in determination of net photosynthetic rate. *Agron. J.* 60:309-311.
5. Brown, K. W. 1969. A model of the photosynthesizing leaf. *Phys. Plant* 22:620-637.
6. Brown, K. W. and N. J. Rosenberg. 1969. Computer program for plotting time dependent meteorological data. *Agric. Meteor.* 6:463-464.
7. Brown, K. W. and N. J. Rosenberg. 1970. Concentration of CO₂ in the air above a sugar beet field. *Mo. Weather Rev.* 98:75- 82.
8. Brown, K. W. and N. J. Rosenberg. 1970. The influence of leaf age, illumination and upper and lower surface differences on stomatal resistance of sugar beet (*Beta vulgaris*) leaves. *Agron. J.* 62:20-24.
9. Brown, K. W. and N. J. Rosenberg. 1970. The effect of windbreaks and soil water potential on stomatal diffusion resistance and photosynthetic rate of sugar beets (*Beta vulgaris*). *Agron. J.* 62: 4-8.
10. Brown, K. W. and N. J. Rosenberg. 1970. Energy and CO₂ balance of an irrigated sugar beet (*Beta vulgaris*) field in the Great Plains. *Agron. J.* 63:207-213.
11. Brown, K. W. and N. J. Rosenberg. 1970. Shading inverted pyranometers and measurements of radiation reflected from an alfalfa crop. *Water Res. Res.* 6:1782-1786.
12. Rosenberg, N. J. and K. W. Brown. 1970. Improvements in the van Bavel-Myer automatic weighing lysimeter. *Water Res. Res.* 6:1227-1229.
13. Briggs, W. W., A. R. Edison, J. D. Eastin, K. W. Brown, J. W. Marencville, and M. D. Clegg. 1971. Photosynthesis light sensor and meter. *Ecology* 52:125-131.
14. Brown, K. W. and N. J. Rosenberg. 1971. Turbulent transport and energy balance as affected by a windbreak in an irrigated sugar beet (*Beta vulgaris*) field. *Agron. J.* 53:351-355.
15. Brown, K. W. and N. J. Rosenberg. 1971-2. Shelter-effects on micro-climate, growth and water use by irrigated sugar beets in the Great Plains. *Agric. Meteor.* 9:241-263.
16. Brown, K. W. and N. J. Rosenberg. 1973. A resistance model to predict evapotranspiration and its application to a sugar beet field. *Agron. J.* 65:341-347.

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17. Duble, R. L. and K. W. Brown. 1973. Environmental concerns for the golf superintendent. USGA Green Section Record. 11:10-13.
18. Brown, K. W. 1974. Calculations of evapotranspiration from crop surface temperature. Agric. Meteorol. 14:199-209.
19. Holder, C. B. and K. W. Brown. 1974. Evaluation of simulated seedling emergence through rainfall induced soil crusts. Soil Sci. Soc. Amer. Proc. 38:705-710.
20. Brown, K. W., C. J. Gerard, B. W. Hipp and J. T. Ritchie. 1974. A procedure for placing large undisturbed monoliths in lysimeters. Soil Sci. Soc. Amer. Proc. 38:981-983.
21. Rosenberg, N.J. and K. W. Brown. 1974. "Self-checking" psychrometer system for gradient and profile determinations near the ground. Agric. Meteorol. 13: 215-226.
22. Spotts, J. W. and K. W. Brown. 1975. A technique for installing induction coils in a profile with minimum soil disturbance. Soil Sci. Soc. Amer. Proc. 39: 1006-1007.
23. Jordan, W. R., K. W. Brown and J. C. Thomas. 1975. Leaf age as a determinant in stomatal control of water loss from cotton during water stress. Plant Physiol. 56:595-599.
24. Brown, K. W. and R. L. Duble. 1975. Physical characteristics of soil mixtures used for golf green construction. Agron. J. 67:647-652.
25. Brown, K. W. 1975. A device for isolating soil columns with minimum disturbance. Soil Sci. Soc. Amer. Proc. 39:1008-1009.
26. Brown, K. W. and N. J. Rosenberg. 1975. Annual windbreaks boosts yields. Crop and Soils Magazine. p. 8-11. Apr-May, 1975.
27. Brown, K. W. 1976. Chapter II. 3. Sugar beet and potatoes. In: Vegetation and the Atmosphere. (J. L. Monteith, ed.). Academic Press, NY. p. 65-86.
28. Thomas, J. C., K. W. Brown and W. R. Jordan. 1976. Stomatal response to leaf water potential as affected by preconditioning water stress in the field. Agron. J. 68:706-708.
29. Deuel, L. E., Jr., K. W. Brown, F. C. Turner, D. G. Westfall and J. D. Price. 1976. Persistence of Propanil, DCA, and TCAB in soil and water under flooded rice culture. JEQ 6:127.
30. Brown, K. W., W. R. Jordan and J. C. Thomas. 1976. Water stress induced alteration in the stomatal response to leaf water potential. Phys. Plant. 37:1-5.
31. Chaudhari, K. G., K. W. Brown, and C. B. Holder. 1976. Reduction of crust impedance to emergence by the addition of manure. Soil Sci. 122:216-222.
32. Deuel, L. E., Jr., F. C. Turner, K. W. Brown and J. D. Price. 1977. Persistence and factors affecting dissipation of molinate under flooded rice culture. JEQ 7:373-377.
33. Brown, K. W. 1977. Chapter 19. Shrinking and swelling of clay, clay strength and other bulk properties of clay soils and clays. In Minerals in Soil Environments. (J. B. Dixon and S. B. Weed eds.). Soil Sci. Soc. of Amer., pp. 680-707, Madison, WI.
34. Brown, K. W., R. L. Duble and J. C. Thomas. 1977. Nitrogen losses from golf green, USGA Green Section Record. 15:5-7.
35. Brown, K. W., F. C. Turner, J. C. Thomas and M. E. Keener. 1977. Water balance of flooded rice paddies. J. of Agr. Water Use 1:277-291.
36. Deuel, L. E. Jr., K. W. Brown, J. D. Price and F. C. Turner. 1977. Persistence of carbofuran and its metabolites, 3-keto and 3-hydroxy carbofuran, under flooded rice culture, JEQ 8:23-26.
37. Brown, K. W., R. L. Duble and J. C. Thomas. 1977. Influence of management and season on fate of N applied to golf greens. Agron. J. 69:667-671.
38. Brown, K. W. and L. J. Thompson. 1977. Dewatering of Confined Dredge Spoil Areas. Second International Symposium on Dredging Technology. 2-4, November, 1977, Texas A&M University pp. G1-1-G1-24.
39. Shive, J. B. and K. W. Brown. 1978. Quaking and gas exchange in cottonwood (Populus deltoides, Marsh) leaves. Plant Physiol. 61: 331-333.
40. Duble, R. L., J. C. Thomas and K. W. Brown. 1978. Arsenic pollution from underdrainage and runoff from golf greens. Agron. J. 70:71-74.
41. Duble, R. L., K. W. Brown and J. C. Thomas. 1978. Increase fertilizer efficiency and reduce nutrient loss. Golf Superintendent 46:28-31.
42. Jones, S. G., K. W. Brown, L. E. Deuel and K. C. Donnelly. 1978. Influence of rainfall on the retention of sludge heavy metals by the leaves of forage crops. JEQ 8:69-72.

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43. Brown, K. W. and J. C. Thomas. 1978. Uptake of nitrogen by grass from septic fields in three soils. *Agron. J.* 70:1037-1040.
44. Brown, K. W., D. C. Anderson, S. G. Jones, L. E. Deuel, Jr., and J. D. Price. 1979. The relative toxicity of four pesticides in tap water and water from flooded rice paddies. *Int. J. Env. Studies.* 141:49-54.
45. Brown, K. W., H. W. Wolf, K. C. Donnelly and J. F. Slowey. 1979. The movement of fecal coliform and coliphage below septic lines. *JEQ* 8:121-125.
46. Wagner, T. L., J. A. Gagne, P. C. Doraiswamy, R. N. Coulson and K. W. Brown. 1979. Development time and mortality of *Dendroctonus frontalis* in relation to changes in tree moisture and xylem water potential. *Environ. Entomol.* 8: 1129-1138.
47. Brown, K. W. and D. C. Anderson. 1980. Effect of organic chemicals on clay liner permeability: A Review of the Literature. In: D.W. Shultz (ed.). *Disposal of Hazardous Waste. Proceedings of the 6th Annual Research Symposium at Chicago, Illinois.* EPA-600/9-80-010. pp. 123-134.
48. Brown, K. W. and L. E. Deuel. 1980. Revegetation of Drastically Disturbed Lands. *Texas A&M Lignite Symposium*, April 17-18, 1980. pp. 19.0-19.8
49. Brown, K. W., L. E. Deuel, Jr. and J. C. Thomas. 1980. Optimization of land cultivation parameters. In: D.W. Shultz (ed). *Disposal of Hazardous Waste. Proceedings of the 6th Annual Research Symposium at Chicago, Illinois.* EPA- 600/9-80-010. pp. 254-259.
50. Brown, K. W. and C. B. Holder. 1980. The relationship between oxygen and water uptake by roots of intact bean plants. *Soil Sci. Soc. Amer. J.* 44:21-25.
51. Brown, K. W., S. G. Jones, and K. C. Donnelly. 1980. The influence of simulated rainfall on residual bacteria and virus on grass treated with sewage sludge. *JEQ* 9(2):261-265.
52. Brown, K. W. and J. C. Thomas. 1980. The influence of the sand layer on available water retention in a golf green. *USGA Green Section Record* 18(6):5-7.
53. Brown, K. W. and J. C. Thomas. 1980. The influence of water stress preconditioning on dark respiration. *Physiologia Plantarum.* 49:205-209.
54. Brown, K. W., J. C. Thomas and A. Almodares. 1980. The necessity of the two-inch sand layer in greens construction. *USGA Green Section Record* 18(6):1-4.
55. Brown, K. W., L. J. Thompson, K. W. Launius and L. E. Deuel, Jr. 1980. Physical properties of dredged materials. *Soil Sci.* 129(2):95-106.
56. Turner, F. T., K. W. Brown, and L. E. Deuel. 1980. Nutrients and associated ion concentrations in Irrigation Return Flow from Flooded Rice Fields. *JEQ* 9(2):256-260.
57. Deuel, L. E. and K. W. Brown. 1980. Impact of surface mining on water quality. *Texas A&M Lignite Symposium*, April 17-18, 1980. pp. 16.1-16.5.
58. Anderson, D. C., and K. W. Brown. 1981. Organic leachate effects on the permeability of clay liners. In: *Proceedings of the 7th Annual Research Symposium at Philadelphia, PA.* EPA-600/9-81-002b, pp. 119-130.
59. Anderson, D. C., K. W. Brown, and J. Green. 1981. Organic leachate effects on the permeability of clay liners. In: *National Conference on Management of Uncontrolled Hazardous Waste Sites held at Washington, D.C.* EPA 600/9-81-002B. pp. 223-229.
60. Brown, K. W., K. C. Donnelly, J. C. Thomas and L. E. Deuel, Jr. 1981. Factors influencing the biodegradation of API separator sludges applied to soils. In: D. W. Shultz (ed.). *Land Disposal: Hazardous Waste. Proceedings of the 7th Annual Research Symposium at Philadelphia, PA.* EPA- 600/9-81-002B. pp. 188-199.
61. Donnelly, K. C. and K. W. Brown. 1981. The development of laboratory and field studies to determine the fate of mutagenic compounds from land applied hazardous waste. In: D. W. Shultz (ed.). *Land Disposal: Hazardous Waste. Proceedings of the 7th Annual Research Symposium at Philadelphia, PA.,* EPA-600/9-81-002B. pp. 224-239.
62. Huddleston, R. L., J. E. Rucker, K. W. Brown and L. E. Deuel. 1982. Evaluation of subsurface effects of long-term landfarming. In: D. W. Shultz (ed.). *Land Disposal: Hazardous Waste. Proceedings of the 8th Annual Research Symposium at Ft. Mitchell, Ky.* EPA-600/9-82-002, pp. 398- 446.
63. Anderson, D., K. W. Brown and J. Green. 1982. Effect of organic fluids on the permeability of clay soil liners. In: D. W. Shultz (ed.). *Land Disposal: Hazardous Waste. Proceedings of the 8th Annual Research Symposium at Ft. Mitchell, Ky.* EPA-600/9-82-002. pp. 179-190.
64. Brown, K. W. 1982. Irrigation of recreational turf with sewage effluent. In: *7th National Turf Conference, S. Australia*, June 6-11, 1982. pp. 73-83.

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65. Brown, K. W. 1982. Quality of irrigation flow from flooded rice paddies. pp. 139-175. Proceedings of the Workshop on Agrichemicals and Estuarine Productivity. Duke University Marine Laboratory, Beaufort, North Carolina.
66. Brown, K. W., L. E. Deuel, F. C. Turner, and J. D. Price. 1982. Quality of irrigation return flow from flooded rice paddies. pp. 153-166. Proc. of National Conference on Irrigation Return Flow Quality Management. Colorado State University, Fort Collins, Co.
67. Brown, K. W., H. Brawand, J. C. Thomas and G. B. Evans. 1982. Impact of simulated land treatment with oily sludges on ryegrass emergence and yield. *Agronomy J.* 74:257-261.
68. Brown, K. W. and K. C. Donnelly. 1982. Mutagenic potential of water concentrates from the effluent of a waste oil storage pond. *Bull. Environ. Contam. Toxicol.* 28:424-429.
69. Brown, K. W., K. C. Donnelly and B. Scott. 1982. The fate of mutagenic compounds when hazardous wastes are land treated. In: D. W. Shultz (ed.). *Land Disposal: Hazardous Waste. Proceedings of the 8th Annual Research Symposium at Ft. Mitchell, Ky.* EPA-600/9-82-002, pp. 383-397.
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71. Brown, K. W., J. C. Thomas and R. L. Duble. 1982. Nitrogen source effect on nitrate and ammonium leaching and runoff losses from greens. *Agronomy J.* 74(6):947-950.
72. Brown, K. W. 1983. Land Treatment of Hazardous Wastes. Chapter 36, pp. 449-474. In: *Environment and Solid Wastes. Characterization, Treatment, and Disposal.* C. W. Francis and S. I. Auerbach (eds.). Butterworths/Ann Arbor Science Book, Woburn, MA.
73. Brown, K. W. and L. E. Deuel, Jr., and J. C. Thomas. 1983. Land Treatability of Refinery and Petrochemical Sludges. Project Summary. EPA-600/S2-83-074.
74. Brown, K. W. and L. E. Deuel, Jr. 1983. An Evaluation of Subsurface Conditions at Refinery Land Treatment Sites. Project Summary. EPA-600/S2-83-096.
75. Donnelly, K. C., K. W. Brown, and B. Scott. 1983. pp. 59-78. The Use of Short-Term Bioassays to Monitor the Environmental Impact of Land Treatment of Hazardous Wastes. (Waters, M. D., S. S. Sandhu, J. Lewtas, L. Claxton, and N. Chernoff and S. Nesnow (eds.). *The Application of Short Term Bioassays in the Fractionation and Analysis of Complex Environmental Mixtures.* Plenum, New York.
76. Brown, K. W., J. W. Green and J. C. Thomas. 1983. The influence of selected organic liquids on the permeability of clay liners. In: D. W. Shultz (ed). *Land Disposal, Incineration, and Treatment of Hazardous Waste. Proceedings of the 9th Annual Research Symposium at Ft. Mitchell, Ky.* EPA-600/9-83-018, pp. 114-125.
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78. Brown, K. W., J. C. Thomas and J. F. Slowey. 1983. The movement of metals applied to soils in sewage effluent. *Water, Air, Soil Pollut.* 19:43-54.
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17. Brown, K. W. and D. C. Anderson. 1983. The Case for Aboveground Landfills. Pollution Engineering, November 1983.
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Grant Projects:

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- "An investigation of the return flow from irrigated land." 1972- 1973. Funded by OWRR for \$31,200. Final Report submitted September, 1974.
- "Fate of metals applied in sewage to land wastewater disposal sites." 1973-1974. Funded by the U. S. Army Medical Corps for \$137,780. Final Report submitted June, 1975.

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- "Nutrient and pesticide retention in golf greens built to USGA Green Section specifications." 1972-1975. Funded by the U. S. Golf Association, Green Section for \$21,000. Final Report submitted October, 1975.
- "An investigation of the feasibility of soil disposal of wastewater from Jefferson Chemical Co." 1975. Funded by the Jefferson Chemical Co. for \$16,600. Final Report submitted October, 1975.
- "The influence of Petro S on the infiltration rate and water holding capacity of soil." 1974-1975. Funded by the Petro-chemical Co., Inc. for \$8,280. Final Report submitted December, 1975.
- "The influence of trickle irrigation on the quality of irrigation return flow." 1973-1974. Funded by Office of Water Resources Research for \$45,000. Final Report submitted March, 1976.
- "Analysis of overburden cores TPPI fuel deposit." 1976. Funded by the Texas Power Pool, Inc. for \$24,500. Final Report submitted February, 1977.
- "Feasibility study of general crust management as a technique for increasing capacities of dredged material containment areas." 1975-1976. Funded by the U. S. Army Engineers Waterways Exp. Station, Corps of Engineers for \$53,529. Final Report published April, 1977.
- "Analysis of four overburden cores." 1977. Funded by the Paul Weir Co. for \$5,600. Final Report submitted July, 1977.
- "Accumulation and passage of pollutants in domestic septic tank disposal fields." 1973-1975. Funded by the U. S. Environmental Protection Agency for \$294,864. Final Report submitted December, 1977.
- "Development of management guidelines to prevent pollution by irrigation return flow from rice fields." 1972-1975. Funded by U. S. Environmental Protection Agency for \$197,850. Final Report published April, 1978.
- "Physiological model of plant growth and development of ecosystem simulation." 1975-1978. Funded by the National Science Foundation for \$129,813. Final Report submitted June, 1978.
- "Evaluate the feasibility of revegetating mixed overburden at the proposed Angelina County lignite site." 1977-1978. Funded by the Sunoco Energy Development Company for \$46,031. Final Report submitted June, 1979.
- "Characteristics of overburden material and revegetation analysis for the Southwest Electric Power Company Deposit." 1977- 1978. Funded by the Southwest Electric Power Company for \$53,600. Final Report submitted July, 1979.
- "The impact of surface lignite mining on surface and groundwater quality." 1978-1979. Funded by the Texas Energy Advisory Council for \$61,022. Final Report submitted September, 1979.
- "Analysis of groundwater quality and the probable quality of leachate, TMPA Fuel Deposit, Grimes County, Texas." 1977. Funded by the Municipal Power Agency for \$20,205. Final Report submitted November, 1979.
- "To investigate the feasibility of irrigation disposal of uranium stripping reclamation water." 1979. Funded by nine private companies for \$9,869. Final Report submitted December, 1979.
- "Statistical and biophysical modeling of Dendroctonus frontalis-Host tree dynamics: II. Physical models of Dendroctonus frontalis - Host tree systems." 1975-1979. Funded by the USFS-CSRS Expanded Southern Pine Beetle Program for \$174,780. Final Report submitted December, 1979."
- "Investigate the concentration of heavy metals and other parameters in lignite overburden cores from Grimes County." 1978. Funded by Texas Municipal Power Agency for \$7,192. Final Report submitted.
- "To investigate the feasibility of irrigation disposal of uranium stripping leach water. Phase II: Laboratory Study." 1979. Funded by Mobil Oil Corp. for \$20,000. Final Report submitted January, 1980.
- "To investigate the necessity of a sand layer between the top mixture and gravel layer in golf green construction." 1978-1979. Funded by the United States Golf Association, Greens Section for \$3,220. Final Report submitted March, 1980.
- "To develop a plan to minimize the volume of runoff water which must be treated and disposed of and to assess the feasibility of land disposal of the runoff water and sludge." 1979-1980. Funded by Texas Engineering Extension Service for \$11,058.40. Final Report submitted April, 1980.
- "Investigate the concentration of heavy metals and certain other physical and chemical properties - Gibbons Creek Lignite Mine." 1980. Funded by Texas Municipal Power Agency for \$12,500. Final Report submitted April, 1980.
- "Improved water and nutrient management through high-frequency irrigation." 1977-1980. Funded by Texas Water Resources Institute for \$179,435. Work completed June, 1980.
- "Environmental and safety aspects of the use of sulfur in highway pavements." 1980. Funded by the DOT-Federal Highway Administration for \$38,951. Final Report submitted August, 1980.